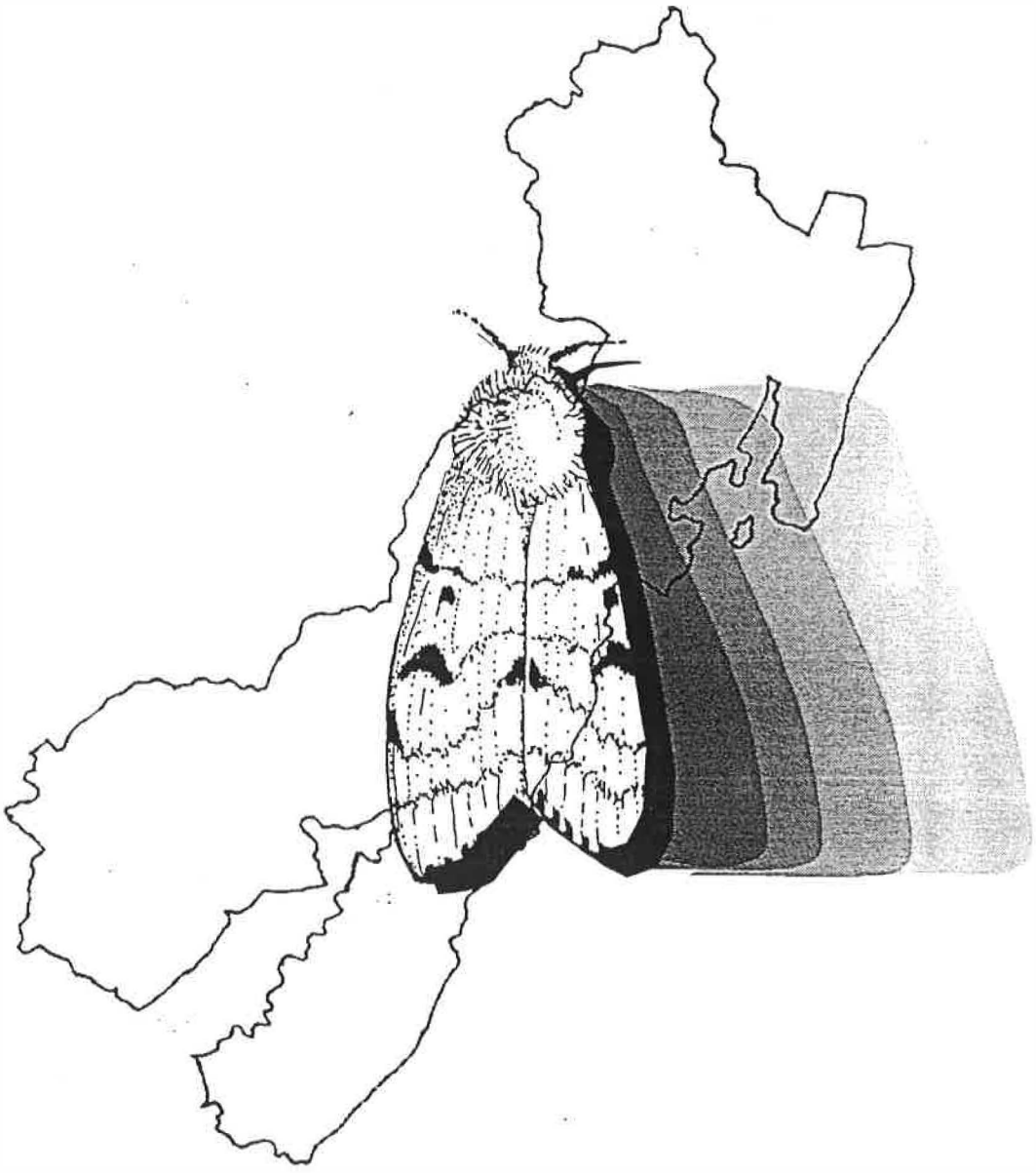
BIOLOGICAL EVALUATION
OF GYPSY MOTH POPULATIONS,
MONONGAHELA NATIONAL FOREST, WEST VIRGINIA
1994



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NORTHEASTERN AREA
State and Private Forestry

BIOLOGICAL EVALUATION OF GYPSY MOTH POPULATIONS MONONGAHELA NATIONAL FOREST, WEST VIRGINIA 1994

SUMMARY

The gypsy moth, *Lymantria dispar* (Linneaus), has defoliated about the same acreage within the Monongahela National Forest (MNF) proclamation boundary during the last several years (3,059 acres in 1994, 5,362 acres in 1993 and 6,499 acres in 1992). However, for the first time the majority of the defoliated acreage (71%) occurred on the Cheat Ranger District (RD); the remainder (29%) occurred on the Potomac RD.

The strategy for gypsy moth integrated pest management (GMIPM) that had been developed and implemented for the MNF in 1992 is presented here as background information. This biological evaluation was conducted within the general guidance of the GMIPM. The biological situation presented herein deals with gypsy moth infestations currently affecting MNF forests. These infestations are likely to impact the management of the MNF's traditional resources of timber, wildlife and recreation, and affect non-traditional resources values of ecosystem biodiversity.

This biological evaluation used gypsy moth egg mass surveys conducted from August to December 1994 to determine the current population densities in forest stands of susceptible oak type on the Cheat, Greenbrier and Potomac RDs. Survey results provide the basis for predicting where gypsy moth infestations in 1995 would exceed each of the three damage thresholds for nuisance, defoliation, and growth loss/tree mortality established under GMIPM.

Criteria for establishing treatment units to reduce the threat of defoliation to the resources were identified jointly by MNF and Forest Health Protection (FHP) personnel. The intent was to determine where gypsy moth infestations would cause the greatest impacts to the National Forest resource values and uses during the next growing season.

Two proposed treatment alternatives were developed that are responsive to the guidance provided by the Monongahela National Forest, Land and Resource Management Plan and Environmental Impact Statement (MNF LMP and EIS). Proposed treatments involve aerially spraying microbial insecticides against gypsy moth larvae for the following reasons: 1) to prevent nuisance and aesthetic loss in developed recreation areas; 2) to reduce tree mortality and maintain wildlife habitat where management goals are timber and wildlife oriented; 3) to enhance visual quality for dispersed recreation; 4) to promote biodiversity through protecting forest health.

INTRODUCTION AND BACKGROUND

Gypsy moth defoliation during 1994 is shown in the context of the entire state of West Virginia to relate the infestation on the MNF to infestation throughout West Virginia (Map 1). Moderate forest defoliation by the gypsy moth has existed on the MNF for at least the last two years based on aerial sketchmapping information (Map 2). About the same extent of defoliation occurred on the MNF between 1992 and 1994, but it shifted from the Potomac RD to the Cheat RD. There have been no forest damage surveys to quantify tree mortality on the MNF as a result of this infestation. However, in similar susceptible oak forests in Pennsylvania, Maryland, Virginia, and the eastern panhandle of West Virginia, gypsy moth infestations have caused substantial oak mortality. Impacts on timber production as well as the permanent alteration of forest stand structure for wildlife habitat and biodiversity also have been documented by forest researchers and managers in these states. The adverse impacts of larval nuisance, defoliation, and tree mortality on developed recreation sites also have been documented elsewhere.

OBJECTIVES

The objectives of this biological evaluation within the context of GMIPM were to: 1) generally estimate gypsy moth population densities within the susceptible forest types of the Cheat, Greenbrier and Potomac RDs; 2) reasonably predict how the damage caused by those populations would impact forest resources during the next growing season; and, 3) develop environmentally responsible and economically feasible management tactics to suppress those populations posing the greatest risk to national forest resource values and uses while maintaining healthy forest ecosystems and protecting species biodiversity in oak habitats.

GMIPM STRATEGY

The following approach to GMIPM was developed for the MNF in FY 1993 by Bob Acciavatti, FHP-Morgantown, and first implemented on the Potomac RD on November 18, 1992. The approach is based on the white paper entitled "Post AIPM Gypsy Moth Management within the Proclamation Boundary of the Monongahela National Forest", jointly agreed to by R-9, MNF and NA, FHP on September 28, 1992, at Elkins, WV. Presentation of GMIPM in this report is important so that this approach can be understood by all MNF personnel responsible for management decisions to deal with gypsy moth infestations.

Procedures

1. The 1994 aerial sketchmapping survey by West Virginia Department of Agriculture field agents located gypsy moth populations at outbreak densities that had defoliated small, scattered areas in the Cheat and Potomac RD forests. Portions of the three northernmost MNF RDs were considered for implementation of GMIPM in FY 1995 as follows:

   Cheat RD - all susceptible oak forest type
   Greenbrier RD - oak forests in Upper East Fork of Greenbrier River
   Potomac RD - all susceptible oak forest type

2. RD personnel provided the direction as to where the most susceptible gypsy moth host tree species (oaks) occurred in compartments with management goals of timber (3.0), wildlife habitat (6.1), dispersed recreation with salvage only (6.2), and developed recreation areas. Surveys were done according to this direction on each RD as follows:

Cheat RD	-	38 timber compartments, 2 recreation areas;
Greenbrier RD	-	12 timber compartment, 3 recreation areas;
Potomac RD	-	41 timber compartments, 5 recreation area.

3. Dave Curry, FHP cooperative agreement employee, and various part-time, temporary employees of the MNF, under the general supervision of Bob Acciavatti, established a variable number of 1/40-acre survey plots within the areas described above. The plots were randomly placed in each surveyed compartment, between August 15 and December 15, 1994.

   At each survey plot, the following data were recorded:
   * the number of new and old gypsy moth egg masses;
   * the estimated percentage of oak trees in and adjacent to the plot;
   * the predominant size class for new egg masses;
   * the presence of *Ooencyrtus* parasitic wasps on egg masses;
   * the evidence of larvae killed by virus (NPV) and *Entomophaga* fungus.

4. FHP used the regression curve of gypsy moth host type defoliation resulting from gypsy moth egg mass densities as published by NEFES, Radnor, PA. Damage thresholds to be expected from the

defoliation, as established under GMIPM, indicated what forest resources values and uses (set as the highest four priorities for protection in the MNF Gypsy Moth Management White Paper) would be impacted by this damage. The following chart presents these gypsy moth egg mass density/damage/ impact thresholds:

GYPSY MOTH DAMAGE AND IMPACT CHART

Gypsy Moth EM/Plot	Gypsy Moth EM/Acre	Forest Host Type Damage Threshold Class	Monongahela NF Forest Resources Impacted
0- 6	< 250	Minimal	None
7-12	250	Larval nuisance to people	Developed Recreation
13-24	500	Visible defoliation of 30-60%	T&ES; Mgt. 8; Class A visual, general forest; nearby private land; RNA
25+	1000 +	Growth loss and dead trees from complete defoliation	Timber sales and high quality sites; hard mast crop; habitat diversity

RNA = Research Natural Area; T&ES = Federally Threatened, Endangered, Sensitive

5. Survey data were interpreted in terms of Damage Threshold Classes which are based on research results and empirical observations as to the effect gypsy moth populations at various densities have on forest trees. For example, the summer refoliation of a tree that experienced spring defoliated exceeding 60 percent often results in depletion of food reserved for new foliage production the next spring. Such a tree may be able to recover from one defoliation/refoliation, but it is unlikely to recover after two successive years of this damage/recovery. Trees depleted of starch food reserves are highly vulnerable to attacks by phloem-feeding beetles, like the two-lined chestnut borer, and infection by the Armillaria root rot fungus.

6. All egg mass survey plot locations were displayed on 7.5-minute USGS Quadrangle Maps using the following color codes for each gypsy moth damage class to help RD personnel visualize the potential damage locations/areas:

Green	MINIMAL
Yellow	LARVAL NUISANCE
Orange	VISIBLE DEFOLIATION
Pink	GROWTH LOSS/DEAD TREES

7. Based on the MNF LMP objectives for the Cheat, Greenbrier and Potomac RDs, decisions were made by Ranger District personnel as to where potentially damaging gypsy moth populations posed the greatest threat to forest resources and uses. The following treatment decision criteria were utilized to establish which locations/areas would benefit most from suppressing gypsy moth infestations in 1995:

A Description of Proposed Treatment Unit Criteria for 1995 Suppression

(1) New gypsy moth egg mass densities: Mod=Moderate (500-1,000/AC); Hi=High (1,000-2,000/AC); VeHI=Very High (2,000-3,000/AC); ExHi=Extremely High (>3,000/AC);
(2) Gypsy moth defoliation in 1994 and 1993;
(3) Timber values and degree of vulnerability of trees to mortality;
(4) Highly sensitive developed/dispersed recreation, scenic and wildlife values;
(5) 1995 WV AGR Cooperative State County Landowner Program (CSCLP) spray block proximity;
(6) Spread of infestation out of USDA-APHIS Quarantine Areas into nearby MNF forested areas;
(7) Retreatment of spray block treated during 1994 suppression project;
(8) Federal TES and WV DNR Non-target Moth Species of Special Concern.

8. Boundaries and acreage were determined by MNF and FHP for each proposed treatment unit to achieve maximum suppression of potentially damaging gypsy moth populations through contracting for aerial spraying in May 1995.

9. MNF notified the public(s) of the intent of the Forest to conduct a gypsy moth spray project. The scoping meetings helped to further identify environmental issues and concerns about the proposed treatments. The environmental effects were analyzed in an EA tiered to the current USDA/APHIS & FS EIS. The EA Decision Notice may decide in favor of the action alternative. The decision is appealable for 45 days after the EA DN is published. If appealled, the proposed action cannot be implemented until 15 days after the appeal disposition.

10. Following the EA DN deciding upon a proposed action, MNF and FHP then plan and organize a spray project using Incident Command System (ICS) to identify key team members. ICS team responsibilities usually involve developing project support activities, schedules, contracting, and procurement of personnel, vehicles, aircraft, supplies, etc.

11. FHP and MNF have established efficacy standards for gypsy moth suppression. A successful project: 1) protects enough foliage (70 percent or more) to keep defoliation from being visibly detected and recorded remotely using aerial methods (sketchmapping/photography/videography flights) in July; 2) reduces gypsy moth populations by 80 percent or more comparing egg mass densities of the generation spraying to that following; 3) maintains residual gypsy moth populations below the threshold densities of 250 or 500 egg masses per acre established for the respective forest resources potentially impacted by gypsy moth damage.

12. FHP evaluates the project against these standards and report the results. The Treatment Monitoring Data Base Protocols and Procedures are to be followed for data collection. This permits a standard for comparison of results among similar projects. It also makes it possible to develop a likely explanation for success/failure on each treatment unit.

13. FHP has responsibility for monitoring impacts to non-target invertebrates before, during and after the spraying. Many macrolepidopterous moths are of special interest in determining biodiversity of ecosystems in the Spruce Knob-Seneca Rocks NRA and in other oak forest habitats on the Cheat and Greenbrier RDs. By surveying the selected groups of non-target moth fauna likely to be feeding and exposed to insecticides in the proposed treatment units during the time of spraying, FHP will document the presence and relative abundance of non-target species considered by WV DNR to be of special concern for their rarity in West Virginia, and/or their listing as federally threatened, endangered, or sensitive. The most complete and valuable information is to be obtained by surveying a variety of habitats from March through October. The Challenge Cost Share Agreements that MNF develops in partnership with the West Virginia Division of Natural Resources and The Carnegie Museum of Natural History has provided the means of meeting this responsibility.

RESULTS AND DISCUSSION

Table 1 shows the 1994 gypsy moth population densities and 1995 damage predictions for the Cheat, Greenbrier and Potomac RD compartments surveyed for this biological evaluation. Maps 3 through 5 show which compartments were included in the survey. The potential for moderate to severe defoliation in 1995 exists within those compartments where the gypsy moth egg masses are most abundant. The measure of abundance used here is expressed as the percent of survey plots falling within the highest damage classes of defoliation and growth loss/tree mortality. When a majority of the survey plots fall into these classes, the likelihood is high for at least moderate and probably severe defoliation in the surveyed compartment/area.

Gypsy moth infestations exist at densities capable of causing visible defoliation leading to unacceptable amounts of growth loss or tree mortality in 16 of the 91 compartments surveyed. On the Cheat RD, 12 of 38 compartments are likely to be severely defoliated in 1995. By contrast, only 3 of 41 compartments of the Potomac RD are likely to experience this intensity of defoliation. Only one compartment on the Greenbrier RD is likely to have severe defoliation.

Gypsy moth populations in the 10 recreation areas would be expected to cause minimal damage in 1995. Although they do present a nuisance to users, they threaten to cause moderate defoliation in only three of the campgrounds surveyed.

Surveys elsewhere on these three RDs indicate that gypsy moth populations were innocuous to non-existent and would not pose a threat to forest resources in 1995. The natural control factors operating in the infestations were not quantitatively surveyed for lack of time, trained field personnel, and staffed laboratory facilities. Certain qualitative observations were made, however. These indicate that gypsy moth egg mass size for new egg masses was moderate to large and there appeared to be a low incidence of *Ooencyrtus* parasitic wasps on the egg masses. There was minimal evidence of larvae killed by nucleopolyhedrosis virus (NPV). The most significant finding was that dead gypsy moth larvae at several sites on the Cheat RD were found to be harboring resting spores of *Entomophaga* fungus. This fungus was known only from the east of the Allegheny Front on the Potomac RD until this survey. On the Potomac RD, the fungus was considered to have influenced the successful treatment of gypsy moth infestations sprayed in that area during May 1993 and most likely in the Seneca Rocks NRA during May 1994.

GMIPM seeks to determine where values are at risk from the current gypsy moth infestations so that treatment units can be established for suppression considerations in 1995. Pre-, and post-suppression egg mass surveys determine gypsy moth population changes and provide a measure of project effectiveness. In addition, treatment evaluation and non-target macrolepidopterous moth monitoring with FHP coordination, insures assessments of forest health impacts resulting from gypsy moth management decisions to spray specified areas. Impacts include those to ecosystem biodiversity and non-target moths in habitats typical of the forest types considered for gypsy moth suppression now and future years.

Potentially damaging gypsy moth populations exist in susceptible forest type within 12 compartments on the Cheat RD, three on the Potomac RD, and one on the Greenbrier RD. Treatment units encompassing these gypsy moth infestations were jointly identified by the MNF and FHP as candidates for spraying to protect forest areas managed for timber, wildlife, recreation and ecosystem biodiversity. These treatment units are shown in Table 2 and Maps 6 through 8.

The gypsy moth infestations on all three of the surveyed RDs are still located along the leading edge of the generally infested area. The recent history of gypsy moth infestations is one of expansion into this part of the MNF where susceptible host tree species are abundant. Considering these facts and the gypsy moth populations found during the surveys for this biological evaluation, FHP predicts that gypsy moth populations will continue to spread and build to outbreak densities on the MNF over the next several years in the general areas discussed in this report.

TREATMENT ALTERNATIVES

All the proposed treatment units have gypsy moth population densities at or above the decision thresholds of 500 and 1,000 egg masses per acre. At these densities, moderate to severe defoliation could potentially result in permanent tree damage/loss of susceptible host type. Eight of the proposed treatment units have densities exceeding 2,000 egg masses per acre, and five exceed 3,000 per acre. Populations at these densities almost certainly would be expected to result in severe defoliation in 1995, and likely continue at that intensity into 1996.

The MNF has two gypsy moth management options in 1995:

1) no action against the gypsy moth infestation;
2) spray designated areas with microbial insecticides (*Bacillus thuringiensis kurstaki* (BTK) or gypsy moth nucleopolyhedrosis virus (NPV), to prevent nuisance, defoliation, and subsequent tree mortality;

If the no action alternative is chosen, pre-suppression population densities within the treatment units (Table 3) indicate that the potential exists for the gypsy moth to cause nuisance and moderate to severe defoliation in large portions of the Cheat RD, and lesser portions of the Greenbrier and Potomac RDs in 1995. The current gypsy moth infestations are in the leading edge of the generally infested area along the southward expansion of gypsy moth. It is under these circumstances that increased risks from the expanding outbreaks may impact the forest most through one or more consecutive years of severe defoliation, leading to increased tree mortality in the oak forest types.

RECOMMENDATIONS

We recommend the MNF consider aerial application to suppress building gypsy moth populations in large portions of the Cheat RD, and in smaller areas of the Greenbrier and Potomac RDs. This action would protect MNF resource values such as recreation, timber, wildlife, and species biodiversity in the oak forest ecosystems. Taking action in 1995 would suppress the gypsy moth populations and reduce the threat of tree growth loss and mortality where Ranger District resource managers have determined that resource values are at greatest risk. Prompt suppression of this infestation is even more appropriate because initial defoliation by the gypsy moth has been minimal on the three northern RDs to date.

Gypsy moth population densities at abnormally high levels currently existing on the Cheat RD need to be reduced below damage thresholds before the outbreak expands and intensifies throughout the Cheat RD. A double application of microbial insecticide BTK would be recommended for gypsy moth populations at these abnormally high densities. Where populations are not at these extreme densities on the Cheat RD, and for the less extreme infestations on the Greenbrier and Potomac RDs, a single application of BTK would still merit consideration to suppress the gypsy moth and to prevent damage to forest health. Where impacts to non-target moths are anticipated, NPV should be considered.

Table 1. 1994 GYPSY MOTH POPULATION DENSITIES AND 1995 DAMAGE PREDICTIONS, MONONGAHELA NATIONAL FOREST, WEST VIRGINIA

CHEAT RD		Autumn 1994 Gypsy Moth Survey Data					Predicted 1995 Gypsy Moth Damage Class			
Timber		Number	Average	Average Gypsy Moth			(Percent of Plots for Each Compartment)			
Compartment		1/40 AC	Percent	Egg Masses/Acre			Minimal	Larval	Visible	Growth Loss
Number	Acres	Plots	Oak/Plot	Old	New	%Change	Damage	Nuisance	Defoliation	/Dead Trees
1	1845	13	50	46	157	241	62	38	0	0
5	1316	20	59	4	24	500	100	0	0	0
6	1864	13	63	18	34	89	92	8	0	0
7	1444	20	50	10	104	940	85	10	5	0
8	423	7	50	23	188	717	71	29	0	0
11	2645	22	64	693	4247	513	4	4	15	77
12	1478	24	40	30	207	590	67	21	4	8
13	1235	16	57	240	1575	556	31	0	19	50
14	2804	19	50	377	3703	882	16	5	5	74
15	1836	20	62	326	4600	1311	0	0	0	100
16	1170	19	23	67	32	-52	100	0	0	0
17	779	5	34	168	224	33	60	20	20	0
18	1917	22	49	33	125	278	77	18	5	0
19	1951	12	67	140	723	416	25	17	17	41
20	2256	27	48	450	6703	1389	4	0	0	96
21	1783	12	59	127	323	154	58	17	17	8
22	3817	17	38	2	115	5650	76	18	6	0
28	766	19	67	13	236	1715	63	21	16	0
29	2266	17	59	336	4254	1166	0	0	0	100
30	1530	25	39	371	1290	252	36	16	8	40
31	4590	48	57	128	2300	1696	4	10	15	71
32	2672	16	62	220	2590	1077	0	0	0	100
33	1787	22	55	87	1240	530	18	18	23	41
34	917	16	42	65	993	1428	6	25	6	63
35	2038	13	37	6	335	5483	38	38	16	8
36	724	21	31	2	240	11900	52	24	24	0
37	2435	31	19	160	1240	675	97	3	0	0
38	2701	9	20	4	173	4225	66	34	0	0
44	2262	20	37	2	144	7100	70	25	5	0
45	1836	14	35	0	60	>100	93	7	0	0
46	733	19	33	19	253	1231	63	5	32	0
47	3832	19	27	0	11	>100	100	0	0	0
48	2869	21	25	0	13	>100	100	0	0	0
49	1486	20	31	5	80	1500	85	15	0	0
50	1438	20	41	0	14	>100	100	0	0	0
51	1798	32	18	0	18	>100	100	0	0	0
52	678	12	35	3	7	133	100	0	0	0
57	4726	10	43	60	200	233	60	30	10	0
TOTALS	74647	712								

Table 1 (cont'd.). 1994 GYPSY MOTH POPULATIONS AND 1995 DAMAGE PREDICTIONS, MONONGAHELA NATIONAL FOREST, WEST VIRGINIA

POTOMAC RD		Autumn 1994 Gypsy Moth Survey Data					Predicted 1995 Gypsy Moth Damage Class			
Timber		Number	Average	Average Gypsy Moth			(Percent of Plots for Each Compartment)			
Compartment		1/40 AC	Percent	Egg Masses/Acre			Minimal	Larval	Visible	Growth Loss
Number	Acres	Plots	Oak/Plot	Old	New	%Change	Damage	Nuisance	Defoliation	/Dead Trees
14	1612	19	56	0	0	0	100	0	0	0
15	985	10	80	348	8	-98	100	0	0	0
16	1381	12	38	330	0	-100	100	0	0	0
17	851	21	53	248	0	-100	100	0	0	0
18	1087	12	58	0	0	0	100	0	0	0
19	1249	5	73	0	0	0	100	0	0	0
20	1932	25	82	64	3	-95	100	0	0	0
24	1306	12	61	1013	10	-99	100	0	0	0
25	829	17	60	466	0	-100	100	0	0	0
26	993	12	66	1770	70	-96	92	0	8	0
31	1508	16	59	43	0	-100	100	0	0	0
32	1433	17	83	186	0	-100	100	0	0	0
33	1234	12	68	60	0	-100	100	0	0	0
36	2070	20	35	384	118	-69	75	20	5	0
38	609	6	57	727	40	-94	100	0	0	0
39	675	10	60	896	24	-97	100	0	0	0
41	1462	12	64	20	0	-100	100	0	0	0
51	466	18	45	0	7	100	100	0	0	0
56	1280	12	53	37	10	-73	100	0	0	0
57	1840	18	59	220	138	-37	93	11	0	6
58	1369	29	66	470	234	-50	90	0	3	7
59	1094	17	65	20	12	-40	59	6	11	24
60	579	6	68	487	73	-85	83	17	0	0
62	1071	11	73	814	98	-88	82	9	9	0
63	1082	15	71	2320	24	-99	100	0	0	0
64	1136	21	57	581	23	-96	100	0	0	0
66	1121	28	68	120	840	600	43	14	7	36
67	740	20	53	22	258	469	65	15	15	5
84	1863	11	49	174	531	205	55	0	27	18
85	899	17	63	19	0	-100	100	0	0	0
88	1685	17	46	14	49	250	100	0	0	0
89	1483	15	65	12	208	1500	60	33	7	0
90	1326	16	52	45	235	422	62	25	13	0
91	2682	3	40	0	80	100	100	0	0	0
92	815	10	68	336	12	-96	100	0	0	0
93	570	4	43	1840	260	-86	75	0	25	0
95	575	12	48	863	3	-99	100	0	0	0
96	1981	21	49	19	800	4110	33	19	15	33
97	1187	18	78	4	13	225	100	0	0	0
101	384	20	48	1006	24	-99	100	0	0	0
103	928	11	45	0	0	0	100	0	0	0
TOTALS	49372	608								

Table 1 (cont'd.). 1994 GYPSY MOTH POPULATIONS AND 1995 DAMAGE PREDICTIONS, MONONGAHELA NATIONAL FOREST, WEST VIRGINIA

GREENBRIER RD		Autumn 1994 Gypsy Moth Survey Data					Predicted 1995 Gypsy Moth Damage Class			
Timber		Number	Average	Average Gypsy Moth			(Percent of Plots for Each Compartment)			
Compartment		1/40 AC	Percent	Egg Masses/Acre			Minimal	Larval	Visible	Growth Loss
Number	Acres	Plots	Oak/Plot	Old	New	%Change	Damage	Nuisance	Defoliation	/Dead Trees
4	1174	20	70	32	150	369	80	10	5	5
5	2943	24	41	10	130	1200	75	16	9	0
6	1955	22	46	2	24	1100	100	0	0	0
7	1173	24	43	0	27	>100	100	0	0	0
8	2277	22	25	3	24	700	100	0	0	0
87	1412	4	80	30	280	833	50	50	0	0
88	781	12	63	13	53	308	92	8	0	0
89	1673	20	54	2	38	1800	95	5	0	0
90	875	16	58	38	72	89	94	6	0	0
91	1080	18	56	24	220	817	88	0	6	6
109	924	19	65	51	408	700	26	37	32	5
110	1547	25	67	59	714	1100	4	20	56	20
TOTALS	17814	226								

POTOMAC RD	Autumn 1994 Gypsy Moth Survey Data					Predicted 1995 Gypsy Moth Damage Class			
Recreation	Number	Average	Average Gypsy Moth			(Percent of Plots for Each Compartment)			
Area	1/40 AC	Percent	Egg Masses/Acre			Minimal	Larval	Visible	Growth Loss
Name	Plots	Oak/Plot	Old	New	%Change	Damage	Nuisance	Defoliation	/Dead Trees
Big Bend C.G.	4	43	1840	260	-86	75	0	25	0
Laurel Fork C.G.	2	0	60	100	67	100	0	0	0
Gatewood C.G.	2	0	20	60	200	100	0	0	0
Sen. Shdws. C.G.	16	68	15	0	-100	100	0	0	0
Spr. Knob L. C.G.	3	0	27	27	0	100	0	0	0
TOTAL	27								

CHEAT RD	Autumn 1994 Gypsy Moth Survey Data					Predicted 1995 Gypsy Moth Damage Class			
Recreation	Number	Average	Average Gypsy Moth			(Percent of Plots for Each Compartment)			
Area	1/40 AC	Percent	Egg Masses/Acre			Minimal	Larval	Visible	Growth Loss
Name	Plots	Oak/Plot	Old	New	%Change	Damage	Nuisance	Defoliation	/Dead Trees
Horseshoe C.G.	2	35	0	0	0	100	0	0	0
YMCA Camp	2	5	200	280	40	50	0	50	0
TOTALS	4								

GREENBRIER RD	Autumn 1994 Gypsy Moth Survey Data					Predicted 1995 Gypsy Moth Damage Class			
Recreation	Number	Average	Average Gypsy Moth			(Percent of Plots for Each Compartment)			
Area	1/40 AC	Percent	Egg Masses/Acre			Minimal	Larval	Visible	Growth Loss
Name	Plots	Oak/Plot	Old	New	%Change	Damage	Nuisance	Defoliation	/Dead Trees
Island C.G.	2	10	40	260	550	50	50	0	0
4-H Camp	2	20	40	40	0	100	0	0	0
Old House P.A.	2	10	40	380	850	50	0	50	0
TOTALS	6								

Table 2. **PROPOSED GYPSY MOTH TREATMENT UNITS, MNF, 1995**

QUAD NAME(S)	TREAT-MENT UNIT	AREA (AC)	MATERIAL BIU/APPS	CRITERIA
Lead Mine/ St. George	101	2197	BTK/24/2	(1) ExHi EM, (2) 1993 N, 1994 N, (3) High Timber Values, (4) High Recreation Values
Leadmine	102	375	BTK/36/1	(1) Mod EM, (2) 1993 N, 1994 N, (3) High Timber Values, (4) High Recreation Values
St. George	103	1619	BTK/24/2	(1) ExHi EM, (2) 1993 N, 1994 L-M, (3) High Timber Values, (4) High Recreation Values
St. George/ Colebank	104	914	BTK/24/2	(1) ExHi EM, (2) 1993 N, 1994 N, (3) High Timber Values, (4) High Recreation Values
St. George/ Parsons	105	847	BTK/24/2	(1) ExHi EM, (2) 1993 N, 1994 L, (3) High Timber Values, (4) High Recreation Values
Parsons	106	1507	BTK/24/2	(1) ExHi EM, (2) 1993 N, 1994 L, (3) High Timber Values, (4) High Recreation Values
Parsons/Montrose	107	1563	BTK/24/2	(1) VeHi EM, (2) 1993 N, 1994 L, 3) High Timber Values, (4) High Recreation and Wildlife Values
Parsons/Montrose	108	2008	BTK/24/2	(1) VeHi EM, (2) 1993 N, 1994 L, 3) High Timber Values, (4) High Recreation and Wildlife Values
Parsons	109	597	BTK/36/1	(1) Hi EM, (2) 1993 N, 1994 N, (3) High Timber Values, (4) High Recreation Values
Montrose/Elkins/ Parsons/Bowden	110	1092	BTK/36/1	(1) Hi EM, (2) 1993 N, 1994 N, (3) High Timber Values, (4) High Recreation Values
Lead Mine	111	146	BTK/36/1	(1) Hi EM, (2) 1993 N, 1994 N, (3) High Timber Values, (4) High Recreation Values
Lead Mine/ St. George	112	425	BTK/24/2	(1) VeHi EM, (2) 1993 N, 1994 N, (3) High Timber Values, (4) High Recreation Values
Montrose	113	256	BTK/36/1	(1) Mod EM, (2) 1993 N, 1994 N, (3) High Timber Values, (4) High Recreation Values
Greenbank	301	971	BTK/36/1	(1) Mod EM, (2) 1993 N, 1994 N, (3) High Timber Values, (5) CSCLP spray block adjacent

Table 2 (cont'd.). PROPOSED GYPSY MOTH TREATMENT UNITS, MNF, 1995

QUAD NAME(S)	TREAT-MENT UNIT	AREA (AC)	MATERIAL BIU/APPS	CRITERIA
Greenbank	302	173	BTK/36/1	(1) Mod EM, (2) 1993 N, 1994 N, (3) High Timber Values, (5) CSCLP spray block adjacent
Upper Tract	501	205	NPV	(1) Mod EM, (2) 1993 N, 1994 N, (4) Popular Hunting Area; (7) Retreatment of 1994 Gypchek spray block, (8) TES VA Big Eared Bat foraging area, WV Non-target Moths of Special Concern
Upper Tract	502	138	NPV	(1) Hi EM, (2) 1993 N, 1994 N, (4) High Value Timber
Circleville	503	639	NPV	(1) Mod EM, (2) 1993 N, 1994 N, (2) High Value Timber, (8) TES VA Big Eared Bat foraging area, WV Non-target Moths of Special Concern

NPV = nucleopolyhedrosis virus
BTK = Bacillus thuringiensis kurstaki

CRITERIA DESCRIPTION

1 - New GM egg mass (EM) densities: Mod=Moderate(500-1000/A; Hi=High (1000-2000/A); VeHi=Very high (2000-3000/A); ExHi=Extremely high (>3000/A)
2 - GM defoliation 1993 and 1994; N=Not visible, L=20-30%,M=30-60%,H=>60%
3 - Timber values and degree of vulnerability to mortality
4 - Highly sensitive developed and dispersed recreation, scenic and wildlife values
5 - WV Cooperative State County Landowner Program (CSCLP) spray block proximity
6 - Spread of infestation out of USDA-APHIS Quarantine Areas and to nearby forested areas of National Forest
7 - Retreatment of spray block from 1994 suppression project
8 - Federal TES and WVDNR Species of Special Concern

TABLE 3. 1995 GYPSY MOTH PROPOSED TREATMENT UNIT DATA, MONONGAHELA NF, WEST VIRGINIA

1994 Gypsy Moth Egg Masses/AC

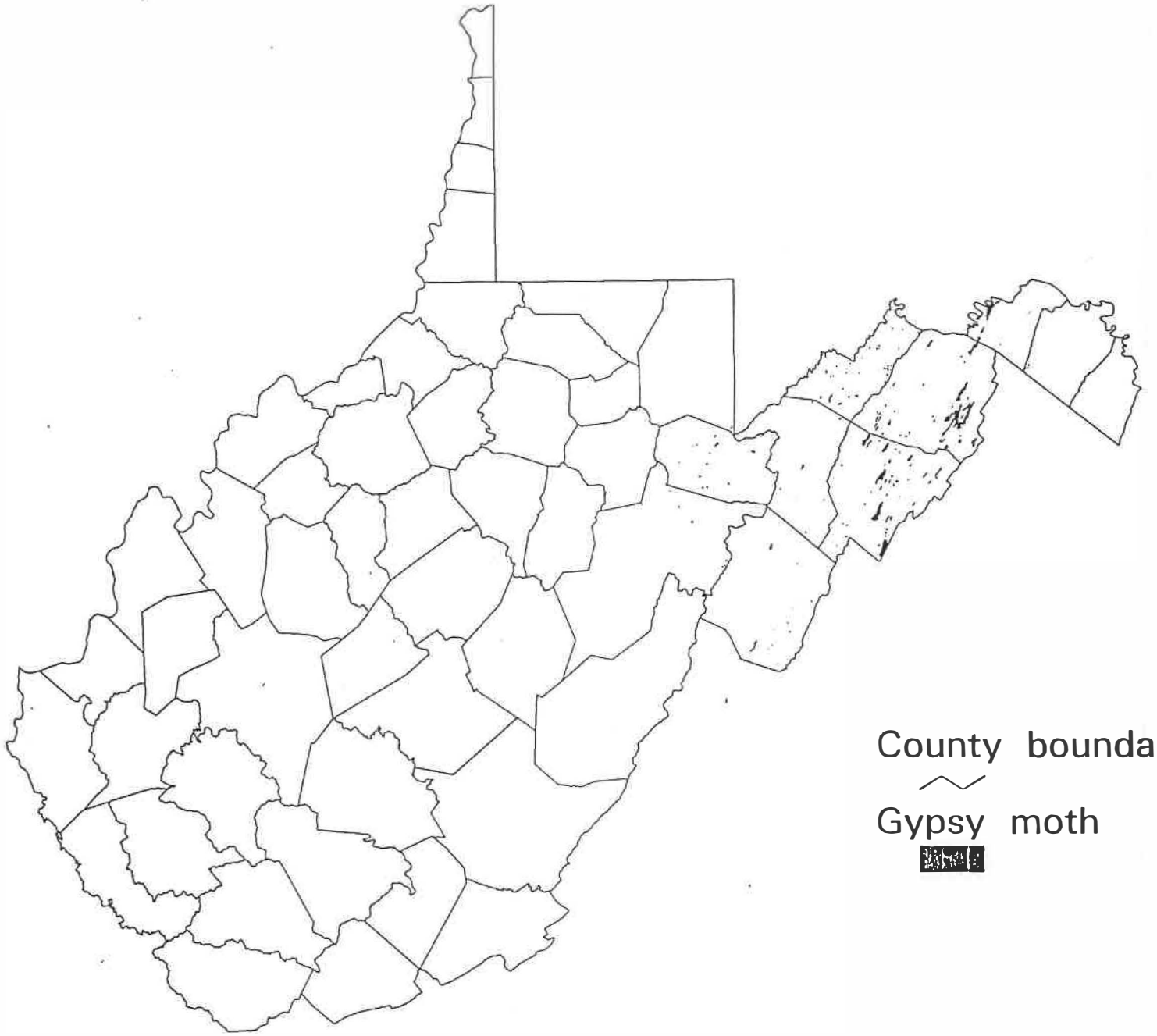
Ranger District/ Unit No.	USGS Quad Name(s)	Treat. Unit (AC)	% Net NFS Comp. Acres	Elev. Limits (ft)	1/40. AC Plots	Sample Mean	Std. Error	Value Range
Cheat/ 101	Lead Mine/ St.George	2,197	83	1,700-2,700	21	4,478	803	360-14,000
Cheat/ 102	Lead Mine	375	25	1,700-2,800	6	480	184	0-1,000
Cheat/ 103	St.George	1,619	58	1700 ~~1,800~~-2,600	19	3,914	885	0-12,000
Cheat/ 104	St.George/ Colebank	914	50	1700 ~~1,000~~-2,600	15	4,400	804	1,000-12,000
Cheat/ 105	St.George/ Parsons	847	38	1700 ~~800~~-2,400	9	5,520	1,536	1,000-15,880
Cheat/ 106	Parsons	1,507	40	1800-2,600	31	3,213	470	0-8,480
Cheat/ 107	Parsons/ St.George	2,796	34	1600 ~~950~~-2,700	26	2,796	528	0-13,400
Cheat/ 108	Parsons/ Montrose	2,008	75	2000 ~~700~~-2,600	16	2,590	614	760-5,240
Cheat/ 109	Parsons	597	65	2000 ~~900~~-2,800	16	993	186	200-3,000
Cheat/ 110	Montrose/ Elkins/ Parsons/ Bowden	1,092	61	2000 ~~850~~-2,950	22	1,295	255	80-4,000
Cheat/ 111	Lead Mine	146	12	1,900-2,800	3	1,813	897	520-4,000
Cheat/ 112	St.George/ Lead Mine	425	34	1700 ~~950~~-2,600	10	2,116	518	0-4,000
Cheat/ 113	Montrose	256	17	1700 ~~800~~-2,600	10	676	245	0-2,000

TABLE 3. 1995 GYPSY MOTH PROPOSED TREATMENT UNIT DATA, MONONGAHELA NF, WEST VIRGINIA

1994 Gypsy Moth Egg Masses/AC

Ranger District/ Unit No.	USGS Quad Name(s)	Treat. Unit (AC)	% Net NFS Comp. Acres	Elev. Limits (ft)	1/40. AC Plots	Sample Mean	Std. Error	Value Range
Greenbrier/ 301	Greenbank	971	63	3,000-4,100	17	762	72	240-1,440
Greenbrier/ 302	Greenbank	173	11	2,750-3,100	6	513	129	120-880
Potomac/ 501	Upper Tract	205	19	1,500-2,000	8	970	282	0-2,212
Potomac/ 502	Upper Tract	138	10	2,000-2,300	3	1,973	1,019	760-4,000
Potomac/ 503	Circleville	639	57	2,600-3,400	9	760	166	0-1,440

1994 Gypsy Moth Defoliation in West Virginia

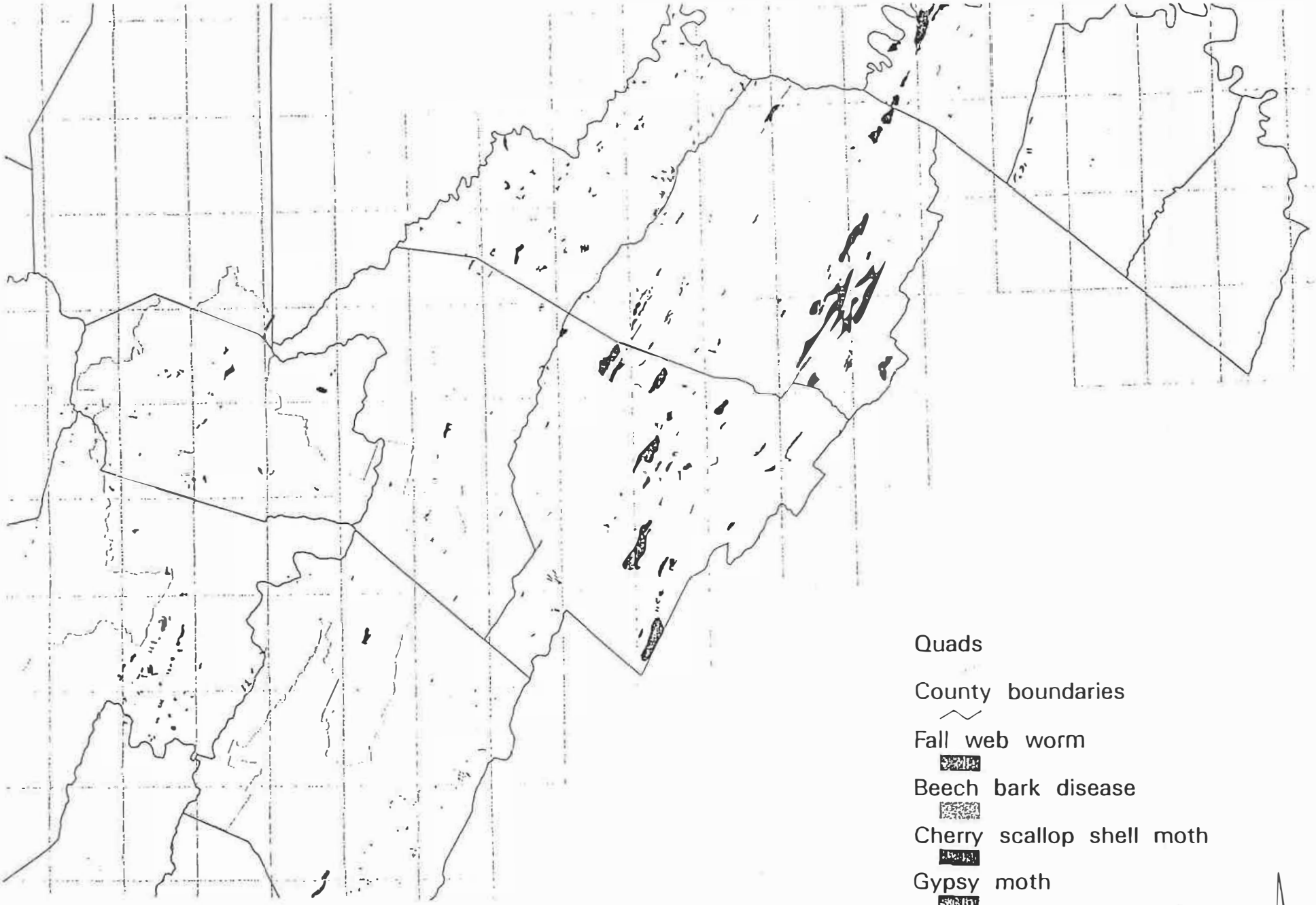


Map 1

Defoliation data aerially sketchmapped by WV Department of Agriculture, Charleston, WV
Produced by USDA Forest Service, Morgantown, WV

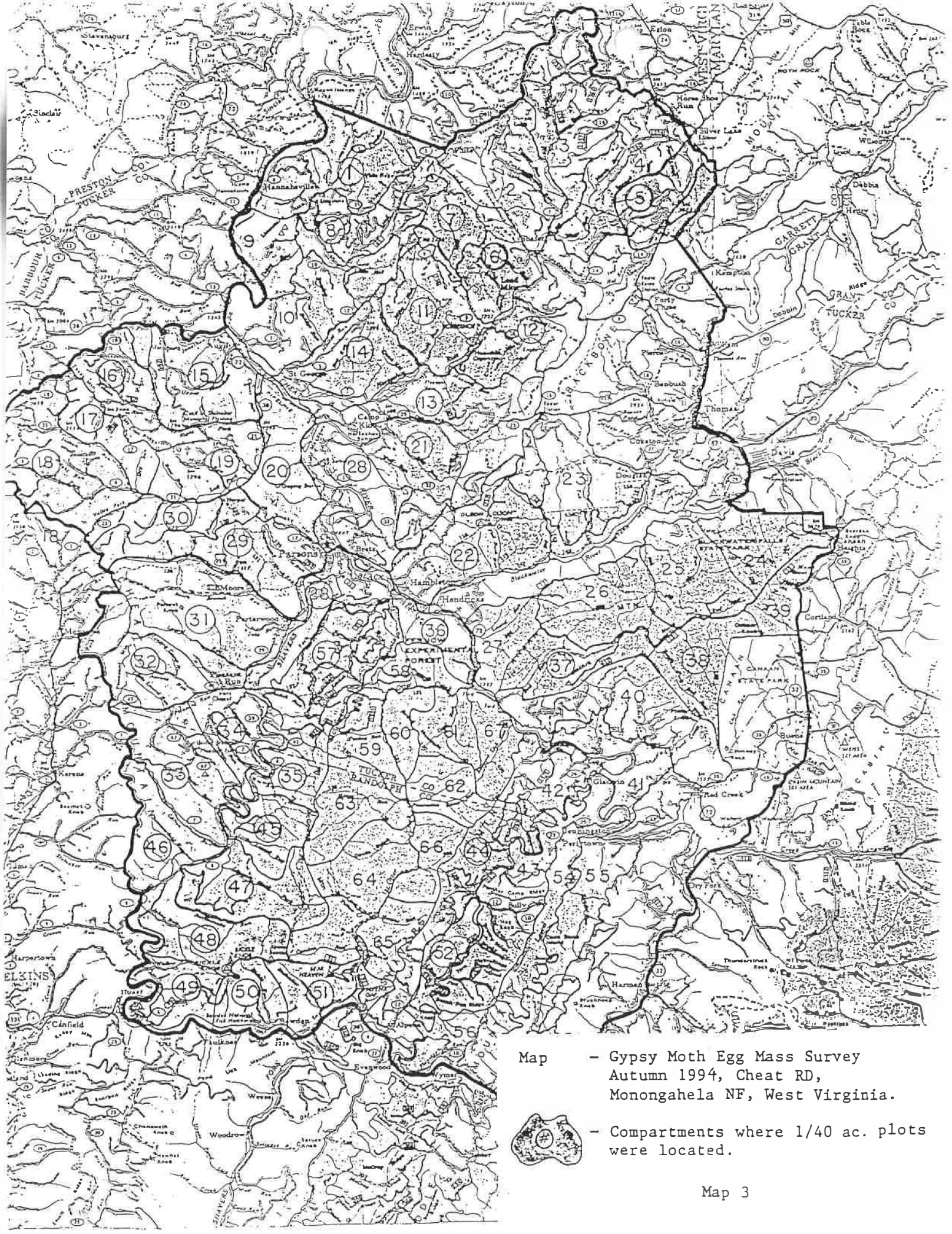
January 1995

1994 Forest Pests in West Virginia



Defoliation data provided by WV Department of Agriculture, Charleston, WV

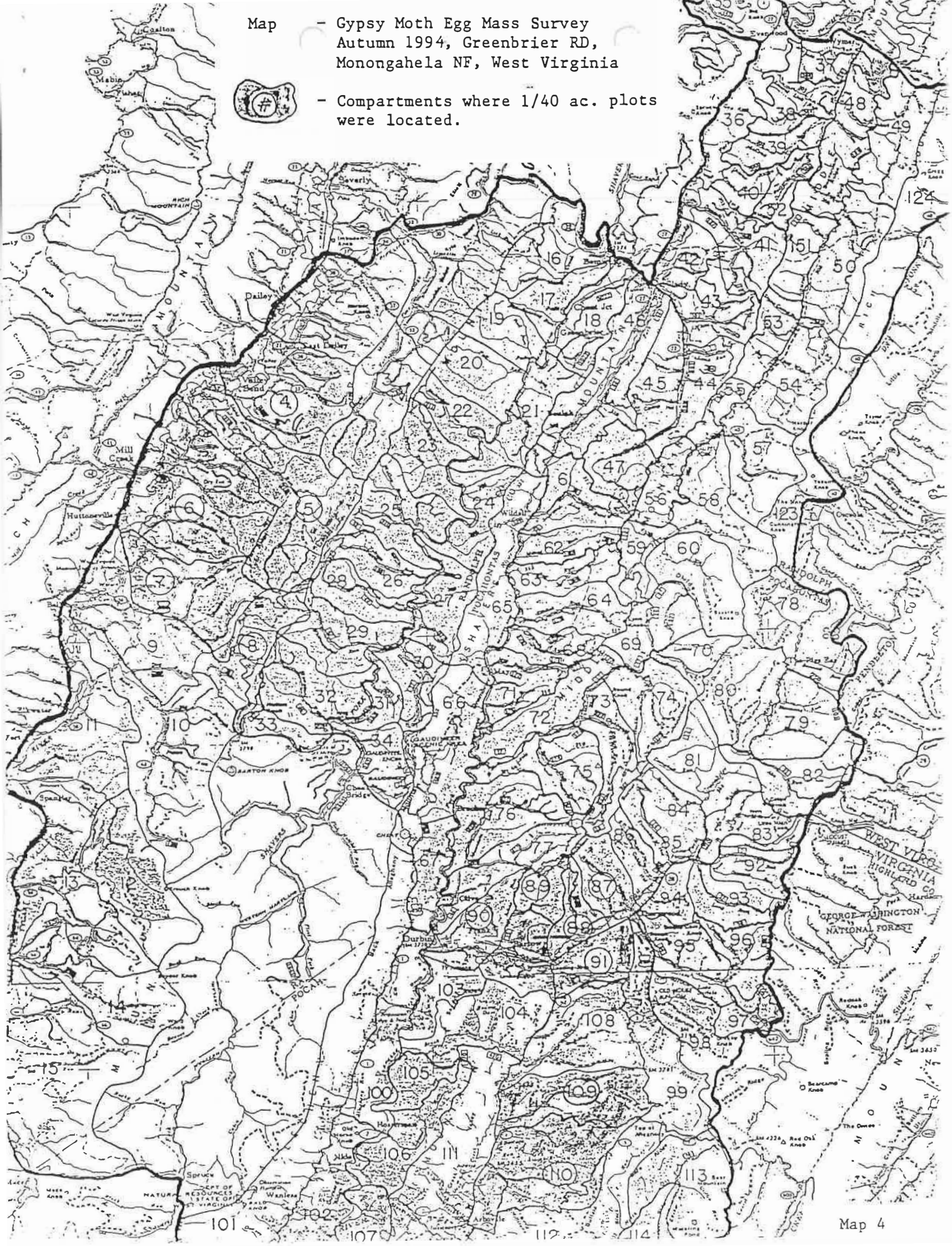
Map 2

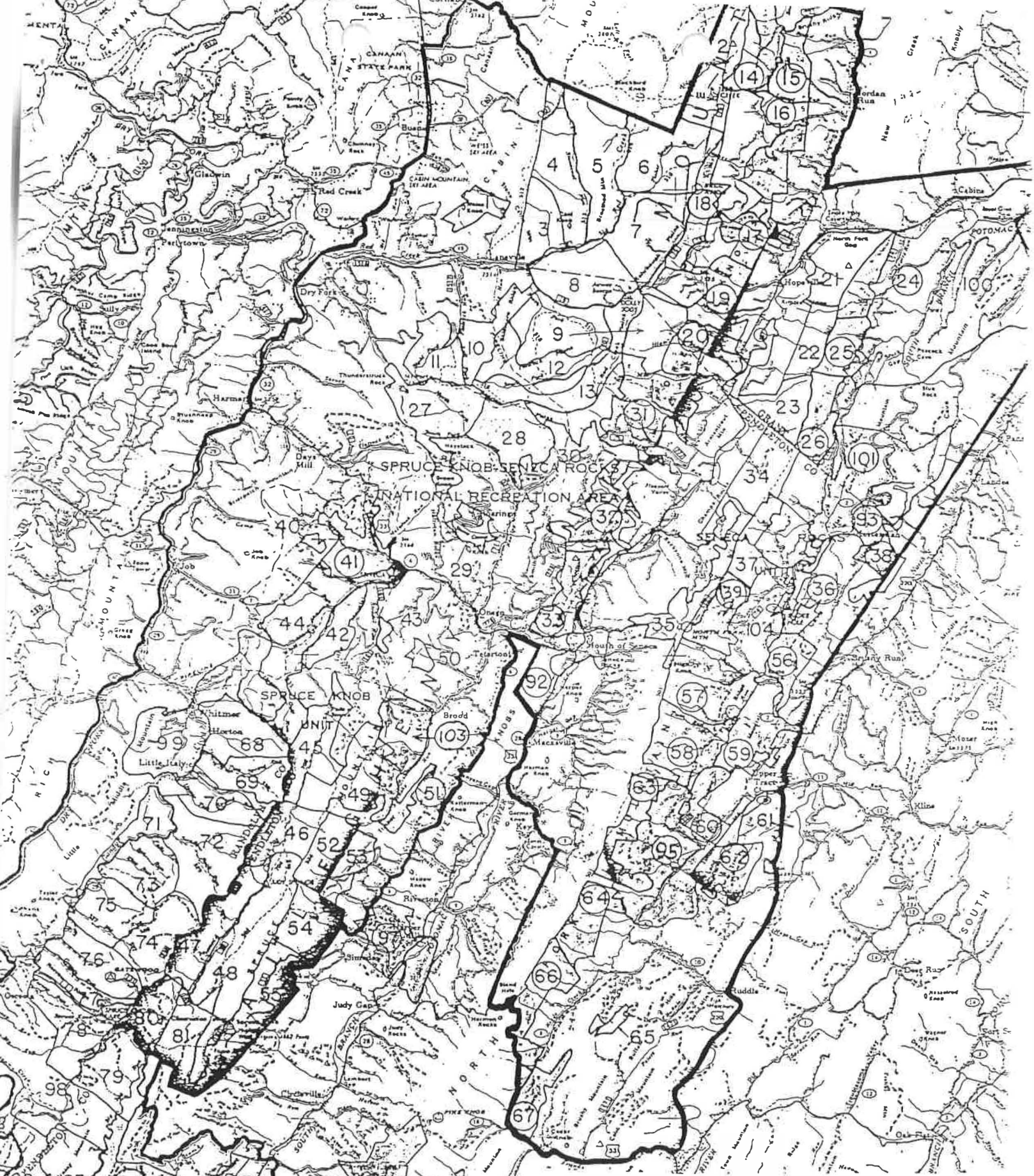


Map - Gypsy Moth Egg Mass Survey
Autumn 1994, Cheat RD,
Monongahela NF, West Virginia.

- Compartments where 1/40 ac. plots were located.

Map 3

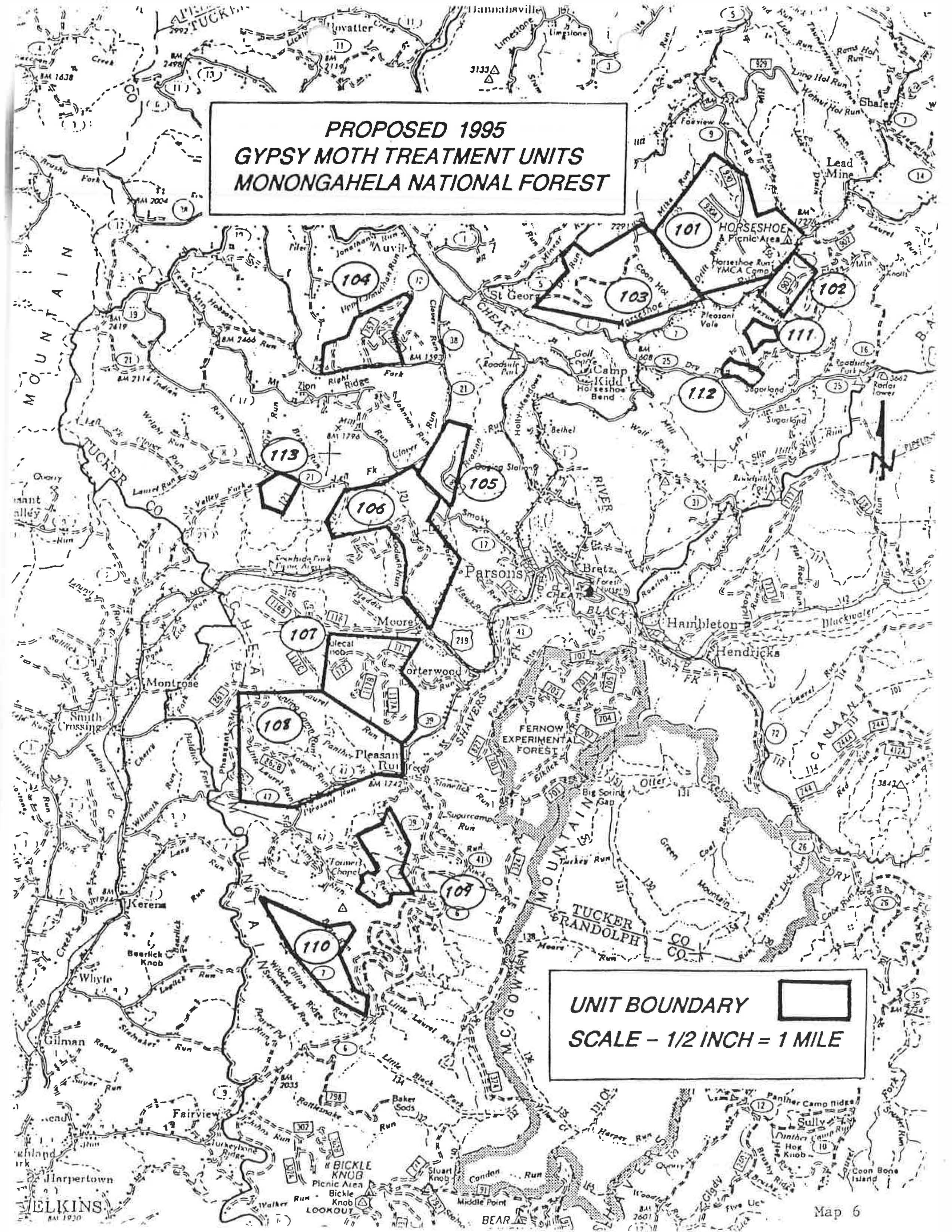

Map - Gypsy Moth Egg Mass Survey
Autumn 1994, Greenbrier RD,
Monongahela NF, West Virginia
- Compartments where 1/40 ac. plots
were located.
Map 4

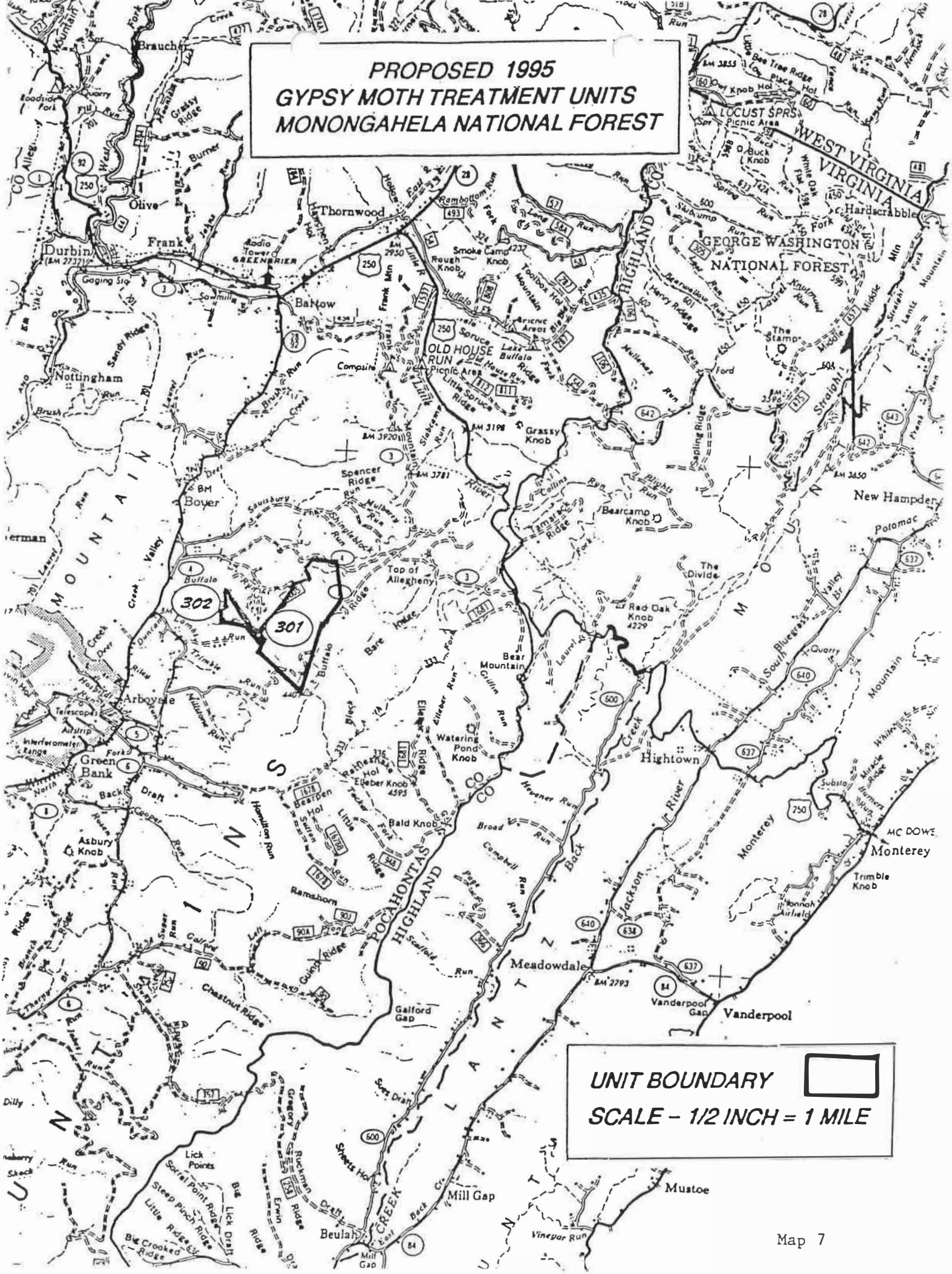


Map - Gypsy Moth Egg Mass Survey
Autumn 1994, Potomac RD,
Monongahela NF, West Virginia

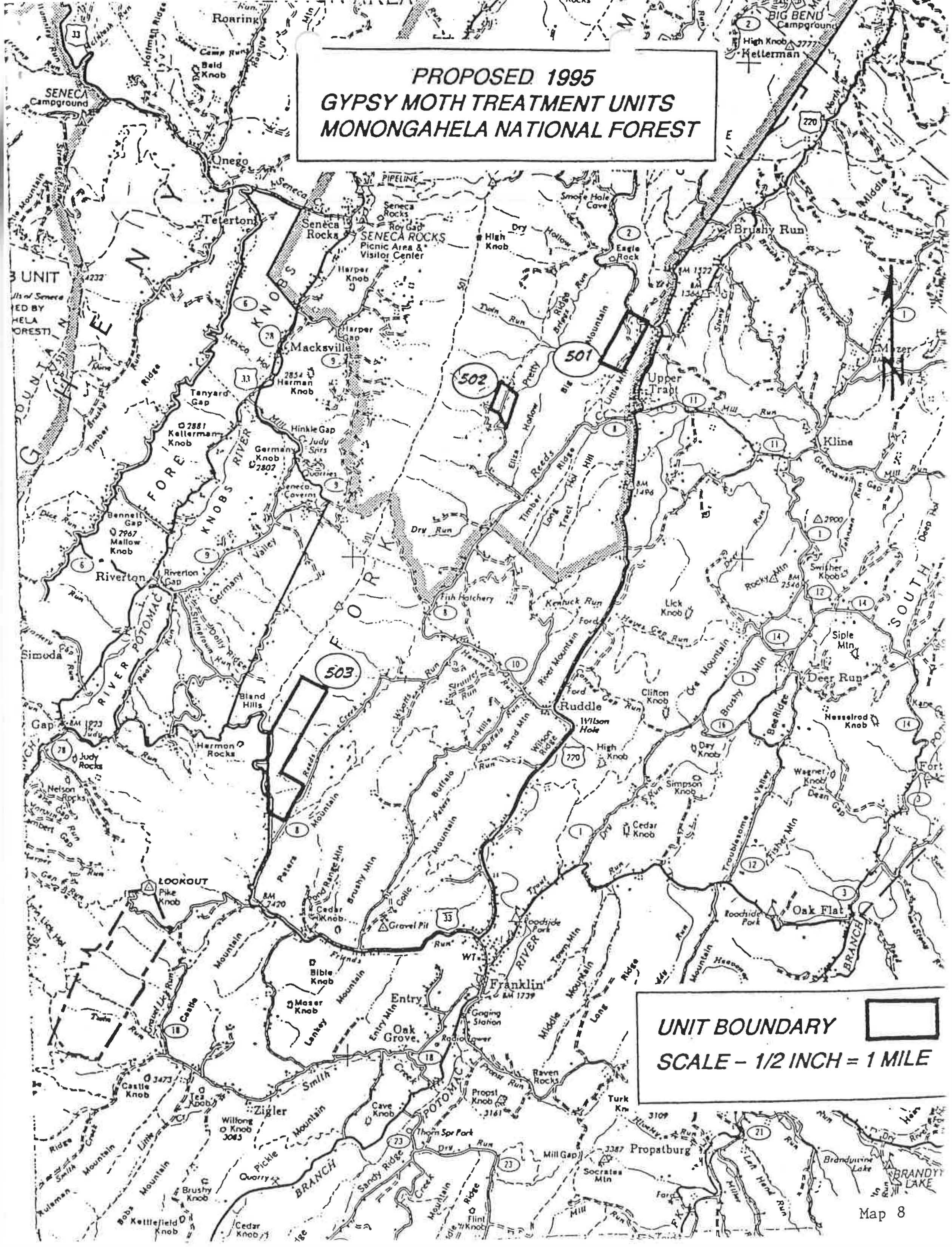
(#) - Compartments where 1/40 ac. plots were located.

Map 5


PROPOSED 1995
GYPSY MOTH TREATMENT UNITS
MONONGAHELA NATIONAL FOREST
UNIT BOUNDARY
SCALE - 1/2 INCH = 1 MILE
101
102
103
104
105
106
107
108
109
110
111
112
113
HORSESHOE
Picnic Area
Horseshoe Run YMCA Camp
St George
CHEAT
Camp Kidd
Horseshoe Bend
Lead Mine
Shafer
Parsons
Bretz
Hambleton
Hendricks
Moore
Porterwood
Pleasant Run
Montrose
Kerens
Whyte
Gilman
Fairview
Harpertown
ELKINS
FERNOW EXPERIMENTAL FOREST
Big Spring Gap
TUCKER CO
RANDOLPH CO
MC GOWAN MOUNTAIN
BICKLE KNOB
Picnic Area
Bickle Knob LOOKOUT
Middle Point
Sully
Coon Bone Island
CANAAN
Smith Crossing
Beerlick Knob
Turners Chapel
Map 6


PROPOSED 1995
GYPSY MOTH TREATMENT UNITS
MONONGAHELA NATIONAL FOREST
302
301
UNIT BOUNDARY
SCALE – 1/2 INCH = 1 MILE

Map 7


PROPOSED 1995
GYPSY MOTH TREATMENT UNITS
MONONGAHELA NATIONAL FOREST
501
502
503
UNIT BOUNDARY
SCALE – 1/2 INCH = 1 MILE
Seneca Rocks
Macksville
Riverton
Franklin
Upper Tract
Ruddle
Oak Flat
Kline
Propstburg
Zigler

Map 8